Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

In the Matter of	)	WT Docket No. 05-235
	)	
Amendment of Part 97 of the Commission's Rules	)	
To Implement WRC-03 Regulations Applicable to	)	
Requirements for Operator Licenses in the	)	
Amateur Radio Service	)	

TO: The Commission

COMMENTS OF STEPHEN W. KERCEL

THIS COMMENTER

1. These are the comments of Stephen W. Kercel ("this commenter"), license grantee of amateur station AA4AK and an Amateur Extra Class licensee. They are being filed in response to the *Notice of Proposed Rule Making and Order* ("Notice") in the heading Docket. This commenter is a Registered Professional Engineer in the States of Maine and Tennessee, has a PhD in Electrical Engineering, and is an adjunct professor in the Department of Psychology at the University of New England. In addition, this commenter has conducted research and published extensively in professional journals on emerging technologies in human-machine interaction, and thus has a unique background in the new technologies that are likely to impact 21st century radio operations.

INTRODUCTION

2. In the Notice, the Commission proposes to revise the Amateur Service rules to eliminate the telegraphy testing requirement for a General or Amateur Extra Class operator license grant. The Commission has heard all the usual arguments (CW is simultaneously the most effective communications mode while requiring the simplest equipment, dropping the code requirement will cause the Amateur Service to degenerate into another Citizen's Band, and so on) as to why the telegraphy testing requirement should be retained, or at minimum should be retained for an Amateur Extra Class operator license grant. In the Notice, the Commission has stated that it is unpersuaded by these arguments. However, there is more to be considered.

TECHNICAL BACKGROUND

3. Notwithstanding a widely-heralded opinion, telegraphy is not a roadblock retarding the adoption of advanced technologies; rather, it is demonstrably a precursor of the radically new communications technologies already on the horizon. New human-machine interface technologies are emerging that will cause a revolution in communications practice that will eclipse past innovations such as the introduction of digital modes. The enabling technologies are based on two different developments. One is an electrotactile interface that enables machine-generated data to be directly coupled from a machine to the human nervous system, where it is experienced by the operator as a direct subjective sensory-emotive experience (for details, see Bach-y-Rita, P. and Kercel, S.W., Sensory substitution and the human-machine interface, *Trends in Cognitive Sciences*, 7(12), pp. 541-546.). The other is an electromyogram-based technology (developed at NASA Ames to enable "hands free" piloting of spacecraft) that enables the human nervous system to transmit data directly to a machine via detection of electric fields radiated by the nervous system (for details, see Wheeler, K.R., Control using gestures sensed from EMG, in Kercel, S.W. (ed.), *Proceedings of the 2003 IEEE International Workshop on Soft Computing in Industrial Applications*, IEEE Catalog Number 03EX688, pp. 21-26.). This is neither science fiction nor speculation; these technologies exist, and have been widely demonstrated and well documented. They are non-invasive (no implanted electrodes), not expensive to implement, and are feasible for use in a variety of industrial and communications applications (for details, see Bach-y-Rita, P., Emerging Concepts of Brain Function, *Journal of Integrative Neuroscience*, 4(2), pp. 183-206.). Operating with such technologies is a "total immersion" experience in which neuroplasticity and unconscious cognition enables the operator to perceive the task as if he/she has "become one" with the process.

RELEVANCE TO THE ISSUE AT HAND

4. Experienced operators will recognize this "total immersion" or "becoming one with the process" as being exactly what happens in CW operation. Received CW characters are not translated or consciously decoded; they are directly *experienced* at a sensory-emotive level, with no conscious effort on the part of the operator. Likewise, transmitted CW is not the result of the operator tapping out counted dots and dashes; rather, one simply thinks the transmission and it emerges from the fingers, at speeds that are well documented to be faster than what is possible for conscious cognition. Of all the modes currently used in the Amateur Service, telegraphy in the only one that requires that the operator become "totally immersed" in the process at a cognitive level.

21st CENTURY TECHNOLOGY REVISITED

5. The usual argument against a telegraphy requirement is based on the (patently and demonstrably untrue) premise that CW is a dying art and by the somewhat questionable premise that a telegraphy requirement is an unnecessary and archaic barrier to the entry of practitioners of "21st century" communications into the Amateur Service. Is this claim valid? Digital modes such as PSK-31 have a long history as *20th century* technologies. They also use a machine to do encoding/decoding, removing much of the cognitive effort from the operator. The trend in modern human-machine interaction is to move in the other direction, to more deeply involve the operator's cognition in the process. The real 21st century innovations in communications will be the completely novel modes based on direct coupling to the nervous system.

IS THE COMMISSION'S CLAIM CONSISTENT?

6. In the Notice the Commission observes that a fundamental purpose underlying Part 97 is "to accommodate the amateur radio operator's proven ability to contribute to the advancement of the radio art." The Commission also observes that "the trend in amateur communications is to use voice and digital technologies for exchanging messages." The implication is that the Commission intends to encourage the trend in order to meet the fundamental purpose. However, is that really what is happening? The "advances" in the digital modes are already made; they were developed in the last century. Amateurs might make incremental improvements in the design of digital communications equipment or the efficiencies in operating procedures, but the real innovations are already accomplished. Digital communicators should be admitted to the ranks of the Amateur Service, but it must be appreciated that their prospective contributions to further advancement of the radio art are more likely to be of an incremental than a breakthrough character.

DOES TELEGRAPHY HAVE THE SAME STANDING AS OTHER MODES?

6. In the Notice the Commission claims that "we should treat Morse code telegraphy as a communications technique with the same standing as other modulation techniques…" The plain fact is that telegraphy does not have the same standing. It differs from all other modes in that it does require the operator to develop the cognitive ability to become totally immersed in the communications process. As such, the experience of telegraphy is more like the emerging technologies of 21st century communication than the mature technologies of 20th century digital communication. It is for that reason that the Commission should recognize that it can and should take a positive step toward encouraging radio amateurs to acquire and retain the cognitive capacities needed to use such breakthrough technologies.

TELEGRAPHY REQUIREMENT FOR AMATEUR EXTRAS

7. Despite the fact that telegraphy is historically the oldest of the communications arts, it is arguably also the first of the new arts that will emerge in the 21st century radio practice. Telegraphy is the only currently-used mode that requires that the operator develop a cognitive capacity for "total immersion" in a communications process. This is a capacity that will be indispensable to the human-machine interface technologies emerging in the new century. If the Commission has a genuine interest in encouraging amateurs to be in the forefront of significant breakthroughs in communication technologies, it should take action to assure that the training and operational disciplines affording such cognitive capacities are not lost to the Amateur Service. A reasonable step toward that preservation is the retention of a telegraphy requirement for the Amateur Extra Class license.

SUMMARY

8. The Commission's claim that telegraphy has the same standing as other modes is factually incorrect; telegraphy requires the development of cognitive capacities that are unnecessary for other modes. Ongoing government funding of the practical development of recent breakthroughs in non-invasive direct coupling between electronic hardware and the human nervous system virtually assure that they will begin to be adopted in military and industrial practice within the next decade. They could also appear in the Amateur Service if the community is prepared to use them. The same cognitive capacities are required for these new modes as are required for telegraphy. It is in keeping with the Commission's objectives of encouraging Radio Amateurs to advance the radio art to preserve the cognitive skills that are indispensable to that development. The retention of a telegraphy requirement for the Amateur Extra Class would assure that the amateur community retains a cadre of operators familiar with the subjective experience of "total immersion" in the communications process. It is such licensees who are likely to make the next substantial breakthrough in the advancement of the radio art. Contrary to a widely-heralded opinion, telegraphy is not an anachronism holding back the adoption of advanced technologies; instead, it is a precursor of the radically new communications technologies that can be expected to appear over the next few decades.

Respectfully submitted,

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